

AIRCRAFT ENGINE STARTING AND EMERGENCY POWER GENERATING SYSTEM

FIELD OF THE INVENTION

This invention relates to turbine engines, and more specifically, to a system that may be alternatively employed to start a turbine engine on an aircraft or to provide power aboard such aircraft in an emergency situation.

BACKGROUND OF THE INVENTION

In so-called "fly-by-wire" aircraft, control surfaces on the aircraft airfoils are not directly mechanically coupled to the controls operated by the pilot. Rather, the couplings are via electrical and/or hydraulic circuits. Needless to say, in order for such couplings to be operative, electrical energy and/or hydraulic fluid under pressure must be available at all times. If there is a failure in an electrical generating system or in a hydraulic pump, the link between the controls and the control surfaces is lost and the aircraft can no longer be controlled.

In the usual case, electrical energy and/or pressurized hydraulic fluid is supplied by one or more pumps or generators driven by the turbine engines used for propulsion of the aircraft, either by thrust or by rotating airfoils. Such turbine engines are equipped with a so-called "AMAD" which is an airframe mounted accessory drive unit. Should the engine, or engines in the case of multiple-engine aircraft, flame out, accessories such as the hydraulic pumps and/or electrical generators driven through the AMAD are no longer driven and control of the aircraft will be lost for the reasons stated.

To avoid this problem, various sorts of emergency power unit systems have been proposed. The purpose of such systems is to provide electrical and/or hydraulic power in the event of an emergency wherein power is not available from the principal power source. The emergency power then provides a link between the control surfaces and the controls allowing the pilot of the aircraft to recover control. Having once recovered control of the aircraft, the pilot may then go about restarting the main propulsion engine or engines.

At the same time, weight in airborne systems is always a concern with every effort being made to minimize weight so as to maximize range and/or payload of the aircraft. Turbine engines used for propulsion, like other engines, require some means of starting them. Not infrequently, a so-called ATSM is connected to each AMAD. An ATSM is an air turbine starter motor and typically includes a turbine wheel connected to the AMAD through which it may drive the main propulsion turbine up to a sufficient speed where it may maintain its own operation. In the usual case, the ATSM is driven by compressed air from any suitable source. Typically, a ground based compressor system such as a so-called ground cart may provide the compressed air. Alternatively, where multiple engines are utilized, the compressed air may be supplied by cross bleed from an already operating engine.

SUMMARY OF THE INVENTION

It is the principal object of the invention to provide a new and improved aircraft engine starting and emergency power generating system wherein a single tur-

bine may be alternatively employed for turbine engine starting purposes or for emergency power generation.

An exemplary embodiment of the invention achieves the foregoing object in a system that is intended for use with an airframe mounted accessory drive unit or AMAD associated with a turbine engine. The system includes a rotary turbine wheel. A clutch is connected to the turbine wheel and has selectively operable first and second rotary outputs, one adapted to be connected as an input to an AMAD and the other adapted to be connected as an input to a power generating apparatus. A nozzle structure is provided for the turbine wheel and is adapted to direct compressed air from a source as a bleed air outlet of a turbine engine or a ground based compressor system, or hot gases of combustion at the turbine wheel. A combustor is connected to the nozzle and a fuel supply is connected to the combustor to provide fuel thereto for combustion therein. A storage tank is also provided for containing an oxidant for the fuel and is connected to the combustor to provide oxidant thereto to support combustion of the fuel therein.

As a consequence of the system, the turbine wheel may be driven by compressed air or by hot gases of combustion with the turbine wheel coupled to the AMAD by the clutch to act as a conventional or emergency starter for a turbine engine associated therewith or, in the alternative, the turbine wheel may be driven by hot gases of combustion with the turbine wheel coupled to a power generating apparatus by the clutch to act as an emergency power unit.

In one embodiment of the invention, the clutch is connected to the turbine by a transmission. Preferably, the transmission is a planetary transmission.

The invention contemplates that the clutch be a two-way clutch. In a highly preferred embodiment of the invention, the two-way clutch is a dump and fill fluid coupling.

The invention contemplates the power generating apparatus be either an electrical generator or a hydraulic pump or both.

In a highly preferred embodiment of the invention, the nozzle structure is a dual nozzle structure having a first nozzle for directing compressed air and a second nozzle for directing gases of combustion. The invention contemplates that the turbine wheel be a radial inflow turbine wheel and that the first and second nozzles be annular and in side by side relation along the axis of rotation of the turbine wheel.

Other objects and advantages will become apparent from the following specification taken in connection with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of certain systems of a multiple turbine engine propelled aircraft and embodying the invention; and

FIG. 2 is a somewhat schematic view of an aircraft engine starting and emergency power generating system made according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An exemplary embodiment of an aircraft engine starting and emergency power generating system is intended for use in a so-called "fly-by-wire" aircraft and may be advantageously employed in one having multiple turbine engines for propulsion as schematically illustrated in FIG. 1. However, it is to be understood that the